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PROCESS FOR MAKING PUTTYLIKE ELASTIC PLASTIC, SILOXANE DERIVATIVE COMPOSITION CONTAINING ZINC HYDROXIDE

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The present invention relates to novel compositions of matter comprising a dimethyl silicone. It is particularly concerned with novel compositions which because of their unusual properties may best be described as "bouncing putties."

The invention is based on the discovery that compositions possessing a unique combination of properties including both a high degree of elasticity or "bounce" under suddenly applied stresses and a high degree of plasticity when the stress is applied more slowly, can be obtained by treating a dimethyl silicone with a compound of boron, preferably followed by a further treatment of the product with heat, a catalyst, or both. By the term "dimethyl silicone," as used herein, and in the appended claims, is meant the oily methyl polysiloxanes obtained by hydrolysis of a pure or substantially pure dimethyl silicon dihalide or equivalent hydrolyzable dimethyl silicon compound and containing an average of approximately two methyl groups per silicon atom, all or substantially all of the silicone silicon atoms being connected to two methyl groups.

Various compounds of boron including pyroboric acid, boric anhydride, boric acid, ethyl borate and other esters of boric acid, etc., may be employed, the selection of any specific boron compound usually depending on the particular combination of properties desired in the final product. Ordinarily, although not always necessarily, the heat- or catalyst-treated product is kneaded by hand or in a dough mixer or a Banbury mixer to bring out more fully its putty-like properties. If desired fillers may also be incorporated both for the purpose of lowering the cost of the product and to facilitate the kneading or working thereof. In some cases marked improvements in the bouncing qualities of the product have been noted after incorporation of a filler.

In order that those skilled in the art better may understand how the present invention is carried into effect, the following illustrated examples are given:

Example 1

Seventy-five parts by weight of a dimethyl silicone oil is thoroughly mixed with 10 parts of pyroboric acid in a small amount of alcohol and the resultant mixture heated in an oven for 2 hours at 150 degrees C. At the end of this time the mixture is in the form of a quasi-rubbery gel. Forty-five parts of the gel is mixed with 90 parts lithopone and 0.9 part of benzoyl peroxide and worked on rubber compounding rolls until a uniform mass is obtained. An additional 45 parts dimethyl silicone oil and 0.9 part benzoyl peroxide is

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then added, worked into the mass, and the resultant product heated in an oven at a temperature of 100 to 150 degrees C. for 2 hours. The final product can be worked between the fingers in the same manner as ordinary window putty, and the more it is worked the more putty-like it becomes. The product also exhibits a high degree of elasticity or bounce.

The use of a hydrolyzable alkyl borate or equivalent catalyst provides a convenient way of obtaining a thorough dispersion of the boron compound in the methyl silicone oil. The following example illustrates the preparation of a plastic, elastic composition by use of an ester of boric acid:

Example 2

A mixture of 200 parts of dimethyl silicone oil, 22.5 ethyl borate and 2.3 parts ferric chloride hexahydrate is placed in a suitable container and steam introduced into the mixture for one-half hour in order to hydrolyze the ester. The resultant product is placed in an oven and heated for 2 hours at 150 degrees C. after which it is worked with 10 per cent by weight of finely-divided titanium oxide until the desired putty-like properties have been obtained.

As has previously been indicated the essential ingredients may be used in various proportions to obtain the desired degrees of elasticity and plasticity. Materials other than the boron compound, and dimethyl silicone oil may also be included to further modify the properties of the products. It is believed that the characteristics of the composition described herein arise from a balance between the hydrophilic and hydrophobic groups, and that the novel material which possesses both elastic and plastic properties is probably a two-phase system comprising a highly cross-linked silicone network with hydrophobic methyl groups attached to the silicon and a viscous liquid reaction product of the boron compound and some of the methyl silicone, which hydrophilic reaction product is a continuous phase between and in the interstices of the cross-linked silicone. This theory as to the nature of the compositions of the present invention appears to be supported by the unique combination of properties thereof. The "friction" between hydrophilic and hydrophobic groups is known to be high. As a result of the "friction" between these groups when the materials of the present invention are subjected to a sudden but not sharp blow, as when dropped on a hard surface, the opposing groups are, for all practical purposes, locked so that the material responds as an elastic solid and exhibits a high